Big Data Technology Capability and Performance of Organizations

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Abstract: *Big data technology is a key trend across different organizations as it enables them to hold the asset "data". The current study assesses technological capability and performance across organizations by means of the empirical study. This has been reviewed with the key focus on the features of big data as well as the benefits to the organization. From the various articles reviewed, the big data technology has been found to be a critical aspect of any organization and hence must be effectively managed to enhance its confidentiality. Organization must, therefore, have proper rules and guidelines on how to handle big data, how it will be analyzed and utilized across the organization with a view to reap maximum business value there in.*

Keywords: Big data capability, Volume, veracity, velocity

1. Introduction

With existence of the database machines since 1970s, there has been emergence of parallel systems where institutions could generate, store and use individual data. The development of large reference data sets and enormously growing raw data streams caused data intensive computing to become big data [5] which commands various sectors of the economy including portable services, retail manufacturing, health and medical services, finance management services and physical sciences [16] and nine out of ten business leaders in Europe consider data as fourth factor of production aside from land, labor and capital. Day by day, there's an Increase in technology adoption across institutions which results to the need to gain a competitive edge by being more flexible, efficient and innovative. This has led to generations of high volume of data which requires capture, storage analysis and management. This data comes from various sources which includes remote sensors which continuously generate much heterogeneous data which are either structured or unstructured [14], daily customers transactions as well as the reports generated from transactional processing systems.

1.1 Big Data Capability

Big data phenomenon has emerged across various organizations and industries among them financial services sector and non-profit making organisations such as churches. According to [25], TDWI research reveals that the value of big data capability lies in the information that necessitates focused marketing, providing revenue-generating modules and building effective customer segmentation. Among other capabilities, big data entails predictive and analytic capability. Predictive capability of big data enables it to build and assess models that generate accurate and consistent predictions of new observations basing the results on the previously stored data. These new predictions can be interpreted temporally and or cross-sectional manner; [41], [47]. The analytical capability, according to [29], enables big data analytics system to process data with vast volume, that is, from terabytes to exabytes, contained in texts, pictures and graphs and velocity which refers to how data flows in from different sources which ranges from batch to streaming. This are enabled with technological resources accompanying the bid data including the database management system and visual technologies.

1.1.1 Performance of the Organisation
Creation of a data driven organization necessitates that the practitioners identify the value of big data analytics in the business and strategic plans of the organization rather than focusing much on the technicalities and understanding the implementation of big data [22]. In a time when the world is a global village, new technologies arise, and new competition is bred. Modern companies must be alert and able to respond to potential threats or opportunities in the market by developing and using dynamic capabilities [35]**.** By using big data analytics, companies are capable of extracting insight from vast amounts of recurring data and a variety of formats [17]. The more often companies engage in sensing and transforming activities, the better their dynamic capabilities will become and the more it will be integrated into the organizational memory [42]. Organizations will therefore, need to examine and renew their capabilities daily.

1.2 Problem Statement

According to central bank of Kenya, it is a requirement of banks in Kenya, under Banking Act Cap 488 to publish performance has over time been reason of imitation by rivals. This, as a result has, lead to cut throat competition. However, researchers such as [4]; [9] agree that analysis of the macro environment is essential in explaining competitive advantage of the firm which includes technology. Further, the researchers point out that firm resources such as technology are vital in product differentiation and thus enable a firm to beat imitations from rival firm and sustain competitive advantage. Similarly, in telecommunication industry, the need for Big Data technology is evident in facilitating client relationship such that effort to maintain data of consumer offers great rewards through product purchases and customer loyalty. Failure to analyze this environment had greatly

caused disadvantages by firms in terms of monitoring competition and reduced personalization in product promotion to clients [38], [45], [7].

Big data platforms have lots to offer the various sectors. From the reviewed literature it is apparent that Big Data is vital in information storage and cuts across various business organizations and economic sectors of a country. For success in use of technology to occur vital factors, among them: relative advantage, observer-ability, complexity and try-ability are necessary [36]. However, the literatures reviewed have been in isolation and as a result the study attempts to establish the composite effect of Big Data characteristics on performance of organizations. This study seeks to review literature on big data technology capability and performance of organizations.

2. Indicators of Big Data

Globally, Big Data technology consists of four key aspects namely Infrastructure data storage, Data Processing and Data Management and Data Analytics [5]. Infrastructure is the scalability and flexibility to handle volumes of data, which consequently makes the cloud to become a natural choice of storage. Data Storage identifies with the temporary or permanent archiving of data to that point where it is retrieved for decision making. Data processing a structure that is used for processing rising volumes of data in parallel, data management ensures the cognizant flow of pertinent information at the right time to the right destination while data analytics provides picturing and predictive analytics [9].

According to [27] five innovation features determine the decision to adopt or to ignore an innovation. This includes relative advantage, trial ability, complexity, observer ability and complexity. Relative advantage emphasizes the ability of innovation to offer superior value to an organization as compared to that of competitors, trial ability measures the level to which an innovation can be experimented or pretested before acquisition or even implementation. Complexity refers to the level to which the innovation is difficult to use, while observer ability refers to the extent of visibility of the results of the innovation by people within and outside the organization. Compatibility refers to the extent of the innovation to be consistent with the organization goals, processes, culture and objectives.

Further, [15] identify four main key features of big data which include: Volume, Variety, Velocity, Value and veracity. Volume presents the most immediate challenge to IT structures. As most companies accumulate huge logs of data, the capability to process the data remains lacking. The ability of big data to process huge amounts of data through big data analytics makes it attractive. Velocity entails the speed through which data is generated, processed, stored and analyzed by relational databases. Big data analytics has the advantage of fast processing, analysis and storage of big data.

2.1 Value of Big Data Adoption

Businesses and organizations gain from more than just the financial assessment of their businesses due to the multidimensional information got from big data analytics. Big data possess various benefits to the economic sectors of a country, among them, improving profits by intermediaries in a distribution system and improvement of data frequency. In the retail industry, many organizations use Big Data analytics to increase the predictability of predictions, expected demand fluctuations and then use the same to react appropriately in response to their environment. In the engineering and manufacturing, big data enables seeking and conceptualizing innovations, foreseeing maintenance problems, enhancement of quality and minimization of costs. In healthcare, big data offers new opportunities to faster respond to probability and occurrence of clinical events such as, disease outbreak, allowing better care for patients and more effective cost management.

In the transportation industry, using technology from traffic controllers enable receipt of climate and weather predictions, symptoms and occurrences, and managers can review performance indicators near real time, particularly luggage delivery, postponements and airport security. Governments, including those of the UK and the US, have increasingly embraced Big Data to facilitate in fraud detection, generation of employment opportunities and better management of processes by parastatals.

2.2 Challenges of Big Data Adoption

Misrepresentation of data reduces the value of the original data, changes the meaning and this may even obstruct effective data analysis. Secondly, reducing devaluation and data compression is effective in reducing the indirect cost of the entire system as if doesn't affect entire data. Identification of this redundant system for elimination may pose quite some risk in tasks and permanent loss of valuable data. Third, in comparison with the relatively slow advances of storage systems, data from pervasive sensors and computing may be incompatible scale-wise posing challenge such as inadequacy of storage system to support such massive data in life cycle management [19].

Fourth, most big data service providers or owners lack effectiveness in managing of massive data due to limited capacity and data storage costs. In resolve this data is left to professionals or tools to analyze which may pose as security/safety threat. Fifth issue may be attributed to the power consumption by the machines used in the process. With the increase of data volume and analytical demands, consumption of electric energy has also been inevitably high [34]. Sixth - the ability of the analytical system of big data to support present and future datasets. Any system should have both the ability to upgrade or to smoothly link with other systems. This calls for the analytical algorithm to be able to process increasingly expanding and more complex datasets, which may not meet user requirement threshold and employee engagement.

The Complexity of the Big Data technology space possesses challenge in selection of right solution, support system offered by vendors and right personnel to facilitate implementation and adoption of big data [13]. According to [31], this necessitates development of comprehensive network architecture that assists experts in various fields in access of relevant data, as well as utilizes their expertise in accomplishing company objectives. This will support the interdisciplinary research which requires experts in various fields to analyze and utilize the potential of big data.

2.3 Emerging Issues

Today, organizations are engaged in adopting a data-driven approach with the aim of growing their businesses and enhancing services delivery to customers. This means that the analytics will be critical for creating competitive advantage for those in the financial and non-financial sector. So far, the existing data analytics practices have simplified monitoring and assessment of organizations. With properly stored, relevant and well-organized data, organizations can be able track client behavior in real time, providing the exact type of product as well as resources needed at the right time. This ensures increase in the overall organization performance and profitability, which further contributes to organization growth. One of the capabilities of big data technologies is analyzing data in real –time or something closer to real [28]. Service sector poses to benefit from customer insights which lead to customer segmentation because of big data analytics. Information collected and evaluated through big data also established focus on key areas for infrastructural improvements, alignment and integration across multiple functional areas. With Big data, issues of confidentiality, privacy and sometimes Identity arise. From the above literature, it emerges that big data is a strategic tool that effectively can lead organizations to strategic competitive advantage. However, key areas that determines this are the environment in which Big Data operates, including Infrastructure, Data Storage, Data Processing and Management; and Data Analytics [43].

2.4 Diffusion of Innovation Theory

Diffusion of innovation theory, developed by [23] explained that the innovation and adoption happened after going through several stages. In the Big Data Adoption context, the spread of this technology is determined by the nature of data that is structured or unstructured, the speed at which data streams in that is velocity t data type i.e. multimedia, as well as the size of data**.** All this can be summarized as BDA External Task Environment, Industry Characteristics and Market Structure. Lack of common standards, the difficulty of integrating BDA with existing organization's' information systems and business processes are some of the issues that pause challenges in the adoption. Studies have shown that companies that perceive high technology complexity act more cautiously in adopting BDA and assimilating it into their enterprises. An innovation needs to be compatible with existing values skills work practice of potential adopters and should be aligned to the existing processes and procedures. Considering the diffusion as a theory, the study will consider

various dynamics of big data and its aspects especially its impacts on users and other existing systems.

2.5 Technology- Organization – Environment (TOE) Framework

Technology-Organization-Environment (TOE) framework developed by [44] has been tested and validated by many studies and used to determine factors that influence the adoption of new technology by enterprises. Various studies have identified that technological, organizational and Environmental factors influence performance of Big Data. Technology includes the elements that facilitate production and in the context of the study, refers to the factors that facilitate information processing, storage and usage. Organization in this context identifies with the arrangement of the resources to facilitate smooth operation of Big Data. The environment in this case is surrounding of the business, which in the case of this study, priority is on the external environment including government regulation and technology advancement [1]. The studies found out that various technological, organizational and environmental factors facilitate or inhibit adoption of new technology in enterprises. The environmental factors include regulatory support, regulatory compliance, security and privacy protection, fair competition, customer satisfaction, regulatory environment, customer trust, business value, customer churning and customer consent [37].

2.6 Technology Acceptance Model

The goal of technology acceptance model (TAM) was to explain the general determinants of computer acceptance that lead to explaining users' behavior across a broad range of end-user computing technologies and user populations. This theory has been used by many scholars: [33], [32] and [12], all of whom have used the theory to explain the adoption of information technology in different fields. In this study, this theory will mainly test two specific beliefs: Perceived Usefulness (PU) - which will focus on an individual organization possibility to adopt big data technology and Perceived Ease of Use (PEU) - which focuses on the potential of subjective view by an individual to use the technology to improve his/her action. Adopting TAM as a theory is important as it expounds much on how users come to accept and adopt technology change. It does this by capturing user's perception and behavior.

2.7 Unified Theory of Acceptance and Use of Technology (UTAUT)

[30] studied from the previous models/theories and formed Unified Theory of Acceptance and Use of Technology (UTAUT). This theory has combines many other eight theories. It uses four predictors of users' behavioral intention including; performance expectancy, effort expectancy, social influence and facilitating conditions. Big data as a technology in the organization has a direct influence on the organizations performance and the people. It is therefore important to look at some other factors such as gender also affects the use of a new technology hence need to use UTAUT. Considering the age and gender, younger people are expected to be more

receptive of the BIG data technology and explore it with an intention of gaining more and more benefits. Under this theory, effort expectancy will also be checked, this varies from one employee to another based on experience.

2.8 Summary of Empirical Review

The drivers of Big Data technology adoption in industries include explosive data growth, regulatory changes, fraud detection and security, and customer insight and market analytics. Advancement in technology and data growth comes when data streams in because of transactions done by customers or captured by different devices such as cameras. This streaming in of data whether internal or external requires better utilization of both existing and new technologies to acquire, organize, integrate and analyze the data. With Big Data, the range of data that can be analyzed varies as the data flows in in different formats. This could be in form of pictures or texts, structured or unstructured. There are different external factors such as Government regulations and even information needs. This therefore leads to the need to for proper understanding for compliance or risk purposes. These compliance requirements plays a greater role on governance and risk reporting, thus need for deeper and more transparent analyses across global organizations which necessitates the institutions to store and analyze many years of transactional data. An example is where banks and financial institutions are required to keep the data about their clients for a period of 7 years. The universality of electronic trading also suggests that capital markets firms both create and react to hundreds of millions of market-related messages each day. This results in an ever-increasing data and analytics burden. Banks and other business institutions have turned to Big Data to identify potential rogue traders, who could conceivably bring massive losses, and to capture and use the data captured to avert fraud. Organizations have used big data about individual transactions to study buyer's behavior. This has led to such organizations predicting individual customer's requirements. Big data enhances good relationship between the customers and the organizations. Given that with big data consumers have smooth relationships with multiple organizations. According to oracle's six patterns big data info graphics, organizations are expanding their analytics investments with belief they have big data analytics covered, however studies show that 60% of such firms started using new analytic techniques, 33% began using new data types, and 32% introduced new metrics/KPIs. Such firms end up realizing that big data solutions require more than isolated technologies; for instance 60% of companies report that a lack of data experts delays big data and analytics project success, 60% of organizations are hindered by too little business intelligence [BI] and very few analytic applications developers, and 10% of employees are contented with the big data technology resources available to them to support analysis and decision-making. The conceptual framework for the study is as shown below.
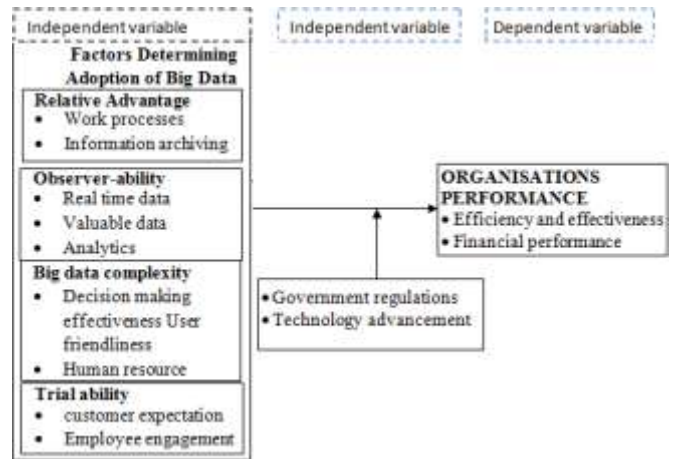

Figure 1: Conceptual Framework

3. Results and Discussion

Big data is used at various stages in the organizations. This ranges from data collection about a particular client up to transactional data per clients. Big data is mostly used for decision making, market analysis and new product development. [2], in a study found out that the most developed industries in utilizing big data are energy (67 %), financial services (43 %), and ICT and logistics (34 %). Success stories of big data analytics implementations in the literature have created a gold-rush-like atmosphere [46]. Some companies' adoption of *big* data analytics can be explained by the concept of isomorphism, which denotes the pursuit of similarities with competing companies. Moreover, some companies' IT innovation and adoption is affected by the adoption of the same concept in a well-known company, regardless of the rationality of doing so [18]. Business insight does not emerge automatically simply by applying technical big data analytics solution to data [40]. Organizations by being able to sense seize and transform the resource base according to the threats and opportunities in the market, companies can continue to search for new temporary advantages [6]. The organizations, must consider the skills, personnel, and technology available. Earlier research suggests that technical, business and relational knowledge is included in this second-order term in addition to technical management [3], [11]. An organization may choose to focus on technical skills and managerial skills as these are important aspects of an organization's big data resources [10]. The skills will enable the adoption and analysis be properly implemented. This will also have a value add since there will be an easier cascade. An organization with high intensity of organizational learning will probably get an advantage in extracting value from big data analytics results [39]. Organizational learning would help individuals to understand various features of big data and even help the personnel to understand and derive value. Big data analytics is an enabler for improved decision making [8], it will redefine how decision making is done and how it affects authority, influence and organizational power [21]**.** With big data, one can track individual transaction and associate them with specific entities hence; it's easier to predict the next occurrence. In the transactions environment, such as Supermarkets, records about individual customers can be stored and they will be able predict buyer's behavior, in

financial institution, the withdrawal or deposit trend of an individual can be tracked to enable the organization predicts the customers need while in scientific field, weather focused will use the stored data to predict the pattern/weather change. The top organization leadership should have a sense which involves searching for new business opportunities and learning about customers, competitors, and the broader market environment [26], [49]. They should be able to scan the marketing environment to get the marketing ability which is the ability of an organization to control and extract value from the market in which operate [48]. To measure these capabilities, one needs to understand the environment which is only possible if data is stored on the same. The environmental factors such as government regulations and ethical requirements will affect storage and accessibility of data hence the same has to be put into consideration. Ones implemented, the organization needs to put in place the rules that governs data access mechanism so that the right persons only accesses the right information. Big data technology is therefore necessary for an organization to succeed both financially and non-financially. Companies therefore need to develop distinctive big data analytics capabilities to capitalize on their big data analytics investments [10]; [24]. Properly implemented Big Data Technology automatically leads to improved profitability and performance of the organization and this fits well when the same is done with proper scanning of the environment and other competitive factors. This is because the company will be able to predict what its customer wants, able to understand what the customers and other organizations think about the company that is company reputation, improved data availability as well as proper data analysis. All this attributes to proper implementation.

4. Recommendations

From the above literature, it is evident that information is a critical aspect of any organization and hence must be effectively managed. Big Data use is therefore vital for large businesses that need to be discreet on important information that facilitate competitive advantage. Future researchers investigating adoption of Big Data technology should consider use of positivism philosophical approach; this is because previous studies have attempted to investigate the adoption of Big Data under normal operational environment. Previous studies have used exploratory, descriptive and cross-sectional research designs. According to [20], this research designs are applicable to new phenomenon or when a researcher intends to establish the existence of a phenomenon. The study proposes that future study should consider use of multi approach research design that incorporates exploratory, cross sectional and descriptive research design to look at how big data capability directly affects the performance of organization. In terms of target population, previous studies have involved institutions and as a result under took case studies and surveys. Based on sampling design, previous studies have used convenience and purposive sampling, since banking institutions are the only providers of such information.

5. Conclusion

In the literature review, first the concept of big data has been defined through the features of big data mainly the four V's. With this definition, the big data landscape of the organizations was studied through the review of the existing literature. The scope further focuses on the capability and performance across organizations by means of the empirical study. Effective investment on big data today considering the technology will be more efficient as compared to the traditional methods which were more cumbersome. Proper implementation wills guarantee immediate feedback hence faster customer service.

References

[1] Ahmad, S., Bakar, A., Faziharudean, T., & K.Zaki. (2015). An empirical study of factors affecting E-commerce adoption among SMEs in a developing country: Evidence from Malaysia. *Information Technology for Development, 21*(4).

[2] Antikainen, M, Lammi, M., Paloheimo, H., Rüppel, T.and Valkokari, K. 2015. 'Towards Circular Economy Business Models: Consumer Acceptance of Novel Services', the ISPIM Innovation Summit, Brisbane, Australia on 6-9 December 2015.

[3] Awa, H., Ukoha, O., & Eke, B. (2016). Adaptation of emerging ICTs: The role of actors in a social network.

[4] Barney, J. (1991). Firm resources ad sustained competiitve advantage. *Journal of Mannagement, 17*(1), 99-120.

[5] Bell, G., Hey, T., & Szalay, A. (2009), Beyond the data deluge. *Science*, 1297-1298. Retrieved May 11, 2015 from [http://www.sciencemag.org/content/323/5919/1297.summary].

[6] Curry, A., & Kkolou, E. (2004). Evaluating CRM to Contribute to TQM Improvement –a cross – case comparison. *The TQM Magazine, 16*(5), 314-324.

[7] Fichman, R.G., & Kemerer, C.E. (1993). Adoption of software engineering process innovations

[8] Bell, G., Hey, T., & Szalay, A. (2009), Beyond the data deluge. *Science*, 1297-1298.

[9] Chen, Y., Wang, Y., Nevo, S., Jin, J., Wang, L., & Chow, W. S. (2014). IT capability and organizational performance.

[10] Bhimani, A. (2015). Exploring big data's strategic consequences. Journal of Information Technology, 30(1), 66-69. doi:10.1057/jit.2014.29

[11] Che, D., Safran, M., & Peng, Z. (2013). From Big Data to Big Data Mining: Challenges, Issues, and Opportunities. In B. Hong et al. (Eds.), Database Systems for Advanced Applications (pp. 1-15). Heidelberg: Springer.

[12] Chen, H., Chiang, R. H. & Storey, V. C. (2012). Business Intelligence and Analytics: From Big Data to Big Impact. MIS quarterly, 36(4), 1165-1188.

[13] Dhar, S. and Mazumder, S. (2014) 'Challenges and best practices for enterprise adoption of big data technologies', Journal of Information Technology Management, December 2014, Vol. 25, No. 4, pp.44–48.

[14] Foya, A. H., Kilika, J., & Muathe, S. (2015). Relating Technology based CRM to service quality in the telecommunications industry in Arush Tanzania. *Science Journal of Business and Management*, 209-218.

[15] Grant, R. M. (2010). *Contemporary strategy analysis and cases* (7 ed.). John Wiley and Sons.

[16] Gupta, J., & George, E. (2016). Toward the development of Big Data analytics capability. *Information and Management*.

[17] Garmaki, M., Boughzala, I. & Wamba, S. F. (2016). The effect of big data analytics capability on firm performance. Paper presented at the PACIS 2016 Proceedings, Chiayi, Taiwan.

[18] Hacker, P., & Zenios, S. (1998). What drives performnce in institutions? *Center for financialinstitutions working papers* (pp. 98-121). Wharton school centre for financial institutions, University of Pennsylvania.

[19] Hao, H. (2013). Quantiying social influence on IT adoption i health care:A Heirarchichal Bayesian learning model analysis.

[20] Heili, J., & Assar, S. (2009). An empirical enquiry into the adoption of open sources software by users in France.

[21] http://www.tanzania.go.tz/egov_uploads/documents/Vol _2_Paper_11__Tanzania_IC T_Sector_Performance_Review_2010_sw.pdf

[22] Ishwarappa, & Anuradha, J. (2015). An Introduction on the Big Data 5Vs characteristics and Hadoop Technology. *Procedia Computer Science, 48*, 319 – 324.

[23] Jagadish, H. V. (2014). Big data and its techncal challenges. *Commun. ACM, 7*, 86-94. Liu, J., Byna, S. and Chen, Y. (2013): "Segmented Analysis for

[24] Jagadish, H. V., Gehrke, J., Labdindis, A., Papakonstantinou, Y., Patel, J. M., Ramakrishnan, R., & Shahabi, C. (2014). Big Data and Its Technical Challenges.

[25] Jones,G.R.(2010).OrganizationalTheory,Design,andChange.PearsonEducation,PrenticeHall

[26] Kwon, O., Lee, N. & Shin, B. (2014). Data quality management, data usage experience and acquisition intention of big data analytics. International Journal of Information Management, 34(3), 387-394.

[27] Materu, M., & Diyamett, B. (2010). Tanzania ICT performance revew towards evidence based ICT policy and regulation. *Tanzania ICT sector performance review*

[28] Materu, M.B., & Diyamett, B. D. (2010). Tanzania ICT Sector Performance Review Towards Evidence-based ICT Policy and Regulation, 2 (11). Retrieved from

[29] Mugenda, O., & Mugenda, A. (2003). *Research Methods: Qualitative and Quantitative Approaches.* Nairobi: Acts Press.

[30] Oghuma, P. (2013). Big Data analytics adaptation in telecmmunication industry. *The Korean Tecles perspective*.

[31] Rahmati, V., Darouian, S., & Ahmadian, H. (2012). A Review on effect of culture, structure, technology and behavior on organizations. *Australian Journal of Basic and Applied Sciences*

[32] Ramdani and Kawalek, (2009), SMEs & IS innovations adoption: a review & assessment of previous research

"Academia revista Latinoamericana de Administracioen, Vol. 39, pp 47-50**.**

[33] Richards, N.M., and King, J.H. (2014): "Big Data Ethics",

[34] Goes, P.B. (2014). Editor's Comments - Big Data and IS

[35] Roberts, N., Campbell, D. E. & Vijayasarathy, L. R. (2016). Using Information Systems to Sense Opportunities for Innovation: Integrating Post adoptive Use Behaviors with the Dynamic Managerial Capability Perspective. Journal of Management Information Systems, 33(1), 45-69.

[36] Rodger. (1995). *Diffusion of Innovations* (4 ed.). New York: Free press.

[37] Rodgers, E. (2005). *Diffusion of innovation.* New York, USA: Free Press.

[38] Russom, P. (2011). *Big Data Analytics.* 1105 Media Inc.

[39] Scott, J. E. (2007). An E-transformation study using the technology-organization-environment framework. university of Canada.

[40] Sharma, R., Mithas, S., & Kankanhalli, A. 2014. "Transforming decision-making processes: a research agenda for understanding the impact of business analytics on organizations," European Journal of Information Systems (23:4), pp. 433-441.

[41] Shmueli, G., and Koppius, O. R. 2011. "Predictive Analytics in Information Systems Research," MIS Quarterly (35:3), pp. 553-572.

[42] Teece, D. (2007). Explicating dynamic capabilities: The nature and microfoundation of (sustainable) entreprise development. *Strategic Management journal, 28*(13), 1319-1350.

[43] Thompson, K. R., S., K., & Maklan, S. (2007). Developing Relationship Marketing Through the Implementation of Customer Relationship ManagementTechnology. *Journal of Business and Marketing*, 58 – 66.

[44] Tornatzky and Fleischer (1990). The process of technological innovation ". Lexington, MA: Lexington Books.

[45] Tonarzky, J., & Heis Thompson, K. R., Knox S. & Maklan, S. (2009). Developing Relationship Marketing Through the Implementation of Customer Relationship Management Technology" Journal of Business and Marketing, 8(4), 58 – 66

[46] Venkatesh, V., & David, F. (1996). A model of the antecedents of perceived ease of use: Development and test. *Decision sciences, 27*, 451-481.

[47] Wessler, M., 2013. Big Data Analytics for Dummies. John Wiley & Sons, Inc., Hoboken, NJ.

[48] Wilden, R. & Gudergan, S. P. (2015). The impact of dynamic capabilities on operational marketing and technological capabilities.

[49] Zhu, F., & Wymer, W. (2002). IT based services and service quality in consumer banking. *International Journal of service industry management, 13*(1), 69-90.